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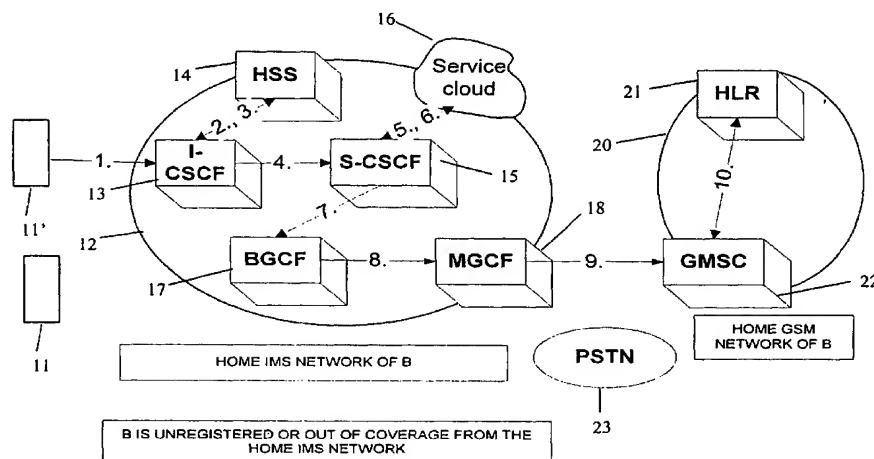
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(54) Title: SYSTEM, DEVICE AND METHOD FOR PROVIDING CALL FORWARDING IN DUAL SUBSCRIPTION MODE

B IS UNREGISTERED FROM IMS, THE CALL IS FORWARDED TO GSM



(57) Abstract: The invention relates to a method and system for providing interworking between a first and a second network of different types, preferably an IMS and a CS (Circuit-Switched) network. A call received by the first network and directed to a terminal unregistered from the first network, is forwarded to the second network, whereas when the call is received by the second network and is directed to a terminal unregistered from the second network, the call is not forwarded to the first network. The same identifier, preferably the same E.164 number, is used in both networks for identifying the called terminal. Preferably, the first network is informed on the registration of the terminal to the second network, the first network using this information as basis for the decision whether or not to route a call to the second network.



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TITLE

SYSTEM, DEVICE AND METHOD FOR PROVIDING CALL FORWARDING IN
DUAL SUBSCRIPTION MODE

5

DESCRIPTION

FIELD AND BACKGROUND OF THE INVENTION

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The invention relates to a system, device and method for providing call forwarding in dual subscription to different types of networks, e.g. a packet-based and circuit-switched network.

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More specifically, the invention relates, according to some of the embodiments, to 3GPP (Third Generation Partnership Project) IP (Internet Protocol) Multimedia network, and to call control, e.g. using a HSS (Home Subscriber Server) or
20 Call Processing Server(CPS).

25

When considering to enable roaming of a user equipment between networks of different types, e.g. between an IMS (IMS; IP Multimedia Subsystem) and a CS (Circuit-Switched)
network, by providing two subscriptions, problems may arise. First, if both subscriptions are unregistered and CS or IMS network receives a call, a forwarding loop may be built: e.g. CS --> IMS --> CS --> IMS --> etc until the network detects and interrupts the loop. Second, if a service such as "Call forwarding on mobile not reachable" contains on both sides
30 (IMS and CS) a routing number to another side, it is not possible to route the call e.g. to voice mail at all in "not reachable" case.

SUMMARY OF THE INVENTION

The present invention provides a system, method and/or device
5 as defined in any of the independent claims or any of the
dependent claims.

The invention presents simple and effective solutions for the
above discussed dual subscription problem and provides
10 interworking ("roaming") between different types of networks,
e.g. IMS (IMS; IP Multimedia Subsystem) and CS (Circuit-
Switched) networks, e.g. in a case where the same identifier
such as E.164 number is used on both sides.

15 No changes are needed in CS network, e.g. GSM (Global System
for Mobile Communications) and especially in HLR (Home
Location Register). The solutions include forwarding only
from one network, e.g. IMS, to the other network, e.g. GSM,
but not vice versa. The solutions use a synonym of the
20 original number as routing number. In some of the
embodiments, the functionality of a mobile terminal is
additionally used.

According to one aspect, the invention provides a simple
25 solution to a stand-alone case (HLR and UMS, User Mobility
Server, are independent and have no interface between them).

According to one of the preferred implementations of the
invention, there is provided a method and/or system for
30 providing interworking between a first and a second network
of different types, wherein a terminal can be registered to
the first network and/or to the second network, wherein a
call received by the first network and directed to a terminal
unregistered from the first network, is forwarded to the

second network, whereas when the call is received by the second network and is directed to a terminal unregistered from the second network, the call is not forwarded to the first network.

5

According to another one of the preferred implementations of the invention, there is provided a method and/or system for providing interworking between a first and a second network of different types, wherein a subscriber entity can be

10 registered to the first network and/or to the second network, wherein a call received by the first network and directed to a subscriber entity unregistered from the first network, can be forwarded to the second network,

- the said forwarding step comprises the following steps:

15 - issuing an enquiry to service execution means, the said enquiry carrying call characteristics,

- the said service execution means arranged to be aware of the conversion capabilities of a gateway means providing media stream conversion between said first and second

20 network,

- the said service execution means inspecting call characteristics,

- the said service execution means making a decision as to whether the call characteristics are such that at least one

25 media stream related to the call can be converted by the said gateway means,

- issuing from the said service execution means a forwarding request to the second network based on the said decision.

30 The subscriber entity may be a SIM or USIM card or other subscription information associated or attachable to a mobile equipment at a given moment in time.

According to another one of the preferred implementations of

the invention, there is provided a method and/or system for providing interworking between a first and a second network of different types, wherein a terminal can be registered to the first network and/or to the second network, wherein a session request received by the first network and directed to a terminal unregistered from the first network, is forwarded to the second network together with an information indicating that the session request was forwarded from the first network.

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BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates a basic structure of a communication system in accordance with an embodiment of the invention,

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Fig. 2 shows an alternative message flow in the embodiment of the invention,

Fig. 3 illustrates a basic structure of a communication system in accordance with another embodiment of the invention, and

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Fig. 4 shows an alternative message flow in the embodiment of the invention.

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DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

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Basically, the invention provides a configurable system and method for dual subscription to different types of networks, e.g. a packet-based, e.g. IP-based, and a circuit-switched network. The embodiments relate to dual subscription to two

networks of different types, i.e. network interworking such as IMS-CS interworking.

Both embodiments according to Figs. 1 and 2 provide call or message forwarding only to one direction, that is from one network to another network of another type, but not vice versa. Some embodiments additionally implement the forwarding only to one direction with the help of a dual-mode terminal that can register into at least two different types of network e.g. IMS and GSM.

Fig. 1 illustrates a first embodiment of the invention which includes a user equipment 11, e.g. a mobile terminal such as a cellular phone or portable computer which is registrable and attachable to a first network 12, preferably a packet-based network such as an IMS (IP Multimedia Subsystem) network. The IMS network 12 is the home IP network of the subscriber B of terminal 11.

The network 12 comprises an I-CSCF (Interrogating Call State Control Function) 13, a HSS (Home Subscriber Server) 14, an S-CSCF (Serving Call State Control Function) 15, a service entity sometimes also termed service cloud 16 which can be a system, method, device, and/or server or alike that can offer services, a BGCF (Breakout Gateway Control Function) 17, and a MGCF (Media Gateway Control Function) 18.

The entity 16 can be an Application Execution Environment (AExE) which receives, from S-CSCF 15, information on the session or call characteristics such as Quality of Service (QoS), admissible delay, jitter, etc.. More generally, the session characteristics are a so-called session description describing the session parameters such as the ones mentioned above, and/or defining the session to be a video call which

may contain video stream and audio stream, an audio call, a stereo audio call etc. The session characteristics may also contain a session description defining the type of coding such as audio coding AMR.

5

The terminal 11 may additionally or alternatively be registrable or attachable to a GSM network 20 which includes a HLR (Home Location Register) 21 and a GMSC (Gateway Mobile services Switching Center) 22. In the shown case, the GSM
10 network 20 is the home GSM network of the subscriber B of terminal 11. Further, a PSTN (Public Switched Telephone Network) 23 is shown in Fig. 1.

The embodiments according to the invention present several
15 implementations described below which may be provided alternatively or cumulatively.

In the case of Fig. 1, the subscriber B, i.e. the terminal 11, is unregistered, or out of coverage, from the home IMS
20 network 12, and a call to terminal 11 received by IMS network 12 is forwarded to GSM network 20.

According to a specific embodiment, when the IMS subscription of terminal 11 is unregistered or the terminal 11 is out of
25 coverage, and the IMS network 12 receives a call to terminal 11, the call is routed to GSM network 20 only when the IMS network 12 deduces of information available that the user might be registered in GSM network 20.

30 According to another implementation of the invention, the mobile terminal 11 knows after every location update that it is registered in GSM network 20. This information can e.g. be transported, for instance after every location update, to the IMS network 12, where it is used as the basis for the

decision whether or not to route the call to GSM network 20 if the terminal 11 loses coverage or becomes unregistered from IMS network 12.

- 5 According to a further implementation, a new service is provided in IMS network 12 that could be called for instance: "Conditional session forwarding on mobile not reachable".

Further, for routing a call from IMS network 12 to GSM
10 network 20, a routing number, which is a synonym of the original identifier of the subscriber B, is used to route the call from IMS to GSM. The original identifier is e.g. an E.164 number or a logical name like john.smith@ims.sonera.fi. The synonym may or may not be the same as the original E.164
15 identifier or part of the original E.164.

Note that an E.164 number is a number identifying a called party or terminal and being structured in accordance with the standard ITU-T Rec. E.164 (international public
20 telecommunication numbering plan). An E.164 number typically consists of three fields, CC (country code), NDC (national destination code), and SN (subscriber number).

In each of the above implementations, when the GSM
25 subscription of terminal 11 is unregistered or the terminal 11 is out of coverage in GSM network, and the GSM network 20 receives a call to terminal 11, the call is not routed to IMS network 12.

30 The embodiment shown in Fig. 1 illustrates a case in which the terminal 11, i.e. subscriber B, is unregistered from IMS 12, and a call is possibly forwarded from IMS network 12 to GSM network 20. In this embodiment, an E.164 (that is an IMS and GSM number) number is used as identifier for calling a

terminal.

In step 1., a call setup message, e.g. an INVITE message of SIP (Session Initiation Protocol), is sent from a terminal 5 11' to I-CSCF 13 for setting up a call to terminal 11. The call setup message indicates an identifier for identifying terminal 11, e.g. 358401223344@ims.sonera.fi indicating the E.164 number of terminal 11.

Step 2: The I-CSCF 13 sends a Location request to HSS 14 10 including the identifier of terminal 11, e.g. 358401223344@ims.sonera.fi.

Step 3: Because the subscriber is not registered in IMS, the HSS 14 indicates this fact to the I-CSCF 13, and may or may not assign a S-CSCF to the call.

Step 4: The I-CSCF 13 chooses a S-CSCF 15 for the call 15 if the HSS did not assign it and sends a message to S-CSCF 15, e.g. an INVITE message with the identifier 358401223344@ims.sonera.fi.

Step 5: S-CSCF 15 makes a query to the service cloud 16 20 with the original number or with a number fetched from the subscriber's profile and asks for the service "Session forwarding on mobile not reachable".

Step 6: The service cloud 16 returns a number that is a synonym of the original identifier, i.e. number, e.g. 25 358491223344. This synonym number is appropriate as a GSM number and is used as routing number.

Step 7: S-CSCF 15 sends a message, e.g. an INVITE message, to BGCF 17 and indicates the routing number 358491223344 in the INVITE message.

Step 8: The BGCF 17 chooses the correct MGCF 18 and 30 sends the INVITE message to MGCF 18 indicating the routing number. MGCF 18 translates the synonym i.e. the routing number to the original E.164 number i.e. 358401223344 if the original E.164 identifier is not conveyed to MGCF.

Step 9: The MGCF 18 sends a setup request to GMSC 22 indicating the E.164 number 358401223344.

Step 10: GMSC 22 sends a Location request to HLR 21 with 358401223344. The HLR 21 returns, if available, the requested
5 information.

When the terminal 11 can be reached, the call is setup to terminal 11, otherwise, the call is handled normally as a call to an unregistered subscriber.

10

In the following, an alternative functioning of the embodiment of Fig. 1 is described wherein another identifier for identifying a called subscriber/terminal is used. In this example, a Universal Resource Locator (URL) such as SIP-URL
15 is used. The step numbering shown in Fig. 1 applies to this embodiment as well.

Step 1: A call setup request message such as an INVITE message of SIP is sent from a call originating terminal 11' to network 12, the message including the identifier e.g.
20 john.smith@ims.sonera.fi of the called terminal.

Step 2: I-CSCF 13 sends a Location request to HSS 14 which request includes the identifier john.smith@ims.sonera.fi.

25 Step 3: Because the subscriber is not registered in IMS network 12, the I-CSCF 13 is informed thereon, and S-CSCF may or may not be assigned to the subscriber. I-CSCF 13 then chooses itself a S-CSCF 15 for the call if the HSS did not assign it.

30 Step 4: I-CSCF 14 sends an INVITE message to the selected S-CSCF 15 with john.smith@ims.sonera.fi.

Step 5: S-CSCF 15 makes a query to the service cloud 16 indicating the identifier john.smith@ims.sonera.fi or a number fetched from the subscriber's profile and asking for

the service "Session forwarding on mobile not reachable".

Step 6: The service cloud 16 returns a number that is a synonym of the original identifier and preferably is the E.164 number, e.g. 358491223344. This synonym number is
5 appropriate as a GSM number and is used as routing number.

Steps 7 to 10 are similar to the above described steps 7 to 10.

In these or other embodiments, a new service like "Voice call
10 forwarding on mobile not reachable" or "Conditional session forwarding on mobile not reachable" is provided. In this embodiment, one of the components of the IMS network 12, e.g. S-CSCF 15, or preferably the AExE 16, checks at least QoS (Quality of Service) requirements e.g. whether the connection
15 request to terminal 11 is for instance a voice call request or another request type, e.g. packet-based connection or data connection. A session forwarding service is continued only when detecting, in this checking step, that the requested connection has such QoS requirements (e.g. voice call) that
20 it can be routed to CS network. This ensures that only those sessions that can successfully be forwarded to GSM (at least QoS is preferably checked), are actually forwarded to GSM.

Fig. 2 shows a case where the subscriber B, i.e. the called
25 terminal 11 is unregistered from the home GSM network 20, and a call to terminal 11 is not forwarded from GSM network 20 to the packet-based network, e.g. home IMS network 12 even when B should be registered in the home IMS network 12.

30 In this case, an E.164 number (that is an IMS and GSM number) is sent from the call originating terminal 11' for identifying B.

In a step 1a, a setup request may be issued from PSTN 23 to GMSC 22 indicating the identifier, e.g. E.164 number, i.e.

+358-40-1223344.

Alternatively, in a step 1b: A setup request indicating the E.164 number of the called terminal 11, e.g. +358-40-1223344, is sent from network 12, i.e. from MGCF 18, to GSM
5 network 20 because the user is unregistered in IMS network 12.

Step 2: The GMSC 22 sends a Location request to HLR 21 with +358-40-1223344.

Step 3: Because the subscriber is not registered in GSM,
10 HLR 21 returns, if available, a "Call forwarding on mobile not reachable" number that is a number e.g. to voice mail. The call is then directed to the voice mail. Otherwise, the call is released.

15 The described embodiments have the advantages of simple structure, and do not require changes of the GSM network. In particular when the GSM subscription is the primary subscription for the user, i.e. the user normally is not registered only in IMS but also in GSM, the greatest part of
20 the calls will be successfully routed.

According to one of the aspects of the invention, when the S-CSCF 15 in the user's home core network such as network 12 receives a session set-up request including the session or
25 call characteristics, it sends this request or at least a request including the session characteristics to the entity (e.g. AExE) 16 which checks, at least when the terminating terminal is unregistered from network 12, the session characteristics for deciding whether or not this session can
30 be routed, i.e. forwarded to the CS-network 20. As an example the entity 16 checks whether the media gateway 18 is able to translate the traffic content of the requested session to a form appropriate for forwarding it to the CS network 20. E.g. the audio/speech coding like AMR of the session to be set-up,

and the possibility of the media gateway to convert the speech coding to PCM coding suitable for network 20, is checked by entity 16. If no proper conversion is available, the entity 16 decides not to forward the session, and informs
5 the CSCF 15 to release the session.

Generally speaking, the network 12, e.g. entity 16, inspects, at least when the terminal 11 is unregistered from the network 12, the session characteristics for checking the
10 possibility of successfully forwarding the session to the CS network 20 after properly converting the session traffic or signalling in the media gateway 18. When detecting an impossibility of proper conversion, e.g. Stereo Audio to PCM (mono) audio, the session is released without forwarding it.

15

When the network 12, e.g. entity 16, detects that the session, e.g. a video call or video stream can not be successfully routed to CS network 20, the network 12, e.g. entity 16, can directly route such a session to an
20 appropriate entity such as a Video Mail System when the terminating terminal 11 is unavailable.

As an alternative, the network 12 can be structured to route a session directed to an unregistered terminal 11 directly
25 from S-CSCF 15 to the media gateway 18. Only when the gateway 18 returns an error message to the S-CSCF 15 because of lack of conversion of the traffic and/or signalling, the S-CSCF 15 addresses entity 16 and requests a decision as to how to further proceed with the requested session. The entity 16
30 then analyzes the session characteristics and instructs the network 12, e.g. CSCF 15, to forward, if possible, the session e.g. to an appropriate mail system such as video mail system.

The interface between S-CSCF 15 and entity 16 can be or use SIP+ or can be implemented as a Service Control Point (SCP).

In a preferred embodiment which may include the above
5 mentioned features, the terminal 11 is a dual-mode terminal. This embodiment is explained with regard to Figs. 1, 2 again.

In this embodiment, when the IMS subscription of the called party is unregistered, and the IMS network receives a call to
10 this party, the call is routed to GSM network only when the network deduces of the information available that the user might be registered in GSM and QoS (Quality of Service) requirement of the call is suitable for successful routing to GSM.

15 However, when the GSM subscription of terminal 11 is unregistered, and the GSM network receives a call for terminal 11, the call is not routed to the IMS network.

20 Alternatively, or additionally, the mobile terminal knows after every location update that it is registered in GSM. This information is transported for instance after every location update to IMS network, where it is used as the basis for the decision whether or not to route the call to GSM if
25 the terminal loses coverage or becomes unregistered from the IMS network. A new service is provided in IMS: "Conditional session forwarding on mobile not reachable".

In the present case, when B is unregistered from IMS, a call
30 is possibly forwarded to GSM. The routing number preferably is a synonym of the original identifier and is used to route the call from IMS to GSM. In this implementation, the E.164 number (that is an IMS and GSM number) is used as identifier of the call terminating terminal 11'.

Steps 1 to 4 of this embodiment are identical to the steps defined above with regard to the E.164 number embodiment.

5

Step 5: S-CSCF 15 checks QoS (Quality of Service) requirements of the call whether the call is a voice call or other type of call that can be successfully routed to GSM and makes a query to the service cloud 16 with the original number or with a number fetched from the subscriber's profile asking "Conditional session forwarding on mobile not reachable".

Step 6: The service cloud 16 returns, if available, a number that is a synonym of the original identifier, e.g. 358491223344. This synonym number is used as routing number.

S-CSCF 15 checks the information available in order to deduce whether the subscriber is registered in GSM. If this is not the case, the S-CSCF 15 makes a further query to the service cloud with the original identifier asking "Session forwarding on mobile not reachable" and routes the session to the received destination, e.g. to voice mail.

If the subscriber is registered in GSM, the process goes to the next steps 7 and following as described above.

In this embodiment, information is provided for IMS about terminal registration in GSM in one or more of the following manners.

30

A. After each successful location update the dual terminal sends a message/information to the IMS network 12. The IMS network records the time of the successful location update in GSM e.g. "registered in GSM at 999999".

B. When the user switches off his dual terminal, the terminal sends a message/information to the IMS network 12 indicating that it is switched off. The IMS network records
5 the state "switched off" i.e. "unregistered from GSM".

C. When the user unregisters from the GSM network, the dual terminal sends a message/information to IMS network 12 that it will unregister from GSM. The IMS network 12 records
10 the state "unregistered from GSM".

D. Valid information about registration in GSM is continuously available in HSS 14.

15 The user may prevent sending message/information of unregistration from GSM and/or switching off the terminal if he e.g. is going to roam to a district, country or alike where IMS network is not available. This may happen e.g. when the user switches off his terminal before boarding an
20 airplane and he knows that in the destination only GSM network is available.

This information is preferably used as follows,

25 When the terminal is not registered in IMS, it is checked whether the terminal is registered in GSM. The information gathered from the terminal is utilized. At least the following alternative rules may be followed according to the operator's preferences:

30 A rule 1 can be: If the terminal is "unregistered from GSM", the call is not forwarded to GSM, otherwise it is.

A rule 2 may be: If the terminal is "registered in GSM at 999999" and the time elapsed since that registration time is not longer than a certain period, the call is forwarded to

GSM, otherwise it is not.

An additional advantage of this solution, in particular compared to the above discussed solution, is that the user
5 can decide very simply whether voice calls are forwarded from IMS to GSM. If he switches off the terminal or unregisters from GSM, the calls are not forwarded to GSM; if he unregisters from IMS or is outside radio coverage from IMS the calls are forwarded to GSM.

10

Some functionality is provided in IMS to keep the information about registration in GSM.

15

Figs. 3, 4 show further embodiments where a session, e.g. a call is forwarded to both directions, i.e. from network 12 to network 20, or from network 20 to network 12.

20

The functionality of CS network 20 is not changed i.e. the IMS network 12 works together with a GSM network of customary structure. The same identifier, e.g. the same E.164 number identifies the subscription in IMS and GSM. A dual terminal may be used.

25

According to some aspects of these embodiments, when the IMS subscription is unregistered, and the network 12 receives a session request, e.g. a call, the session is routed to GSM network 20. When the GSM subscription is unregistered, and the network 20 receives a session request, e.g. a call, the session is routed to IMS network 12. A routing number or
30 identifier, which may be a synonym of the original E.164, is used to route the session from IMS 12 to GSM network 20. A routing number or identifier, which may be another synonym of the original E.164, is used to route the session from GSM 20 to IMS 12 network.

The functionality at I-CSCF 13 in IMS network 12 is as follows.

- 5 1) Do the UMS query always with the original identifier, e.g. the original E.164, and translate, if needed, the identifier, e.g. E.164 from synonym (i.e. the routing number) to the original identifier, e.g. E.164.
- 2) If the subscriber is registered in UMS, route the session,
10 e.g. call, to the correct S-CSCF 15.
- 3) If the subscriber is unregistered in UMS, choose a S-CSCF and route the session there with information that the subscriber is unregistered.

15 The functionality at S-CSCF 15 in IMS network 12 is as follows.

- 1) If the subscriber is registered in UMS, translate the identifier, e.g. E.164 to the original one when needed,
20 consult the service cloud 16 and route the session, e.g. call according to the given advice, normally to the subscriber.
- 2) If the subscriber is unregistered in UMS:
 - if the E.164 is the original E.164 (i.e. the session e.g. call is not coming from GSM network 20) and the QoS of
25 the session is such that the session can be routed or is reasonable to route to GSM, translate the E.164 to a GSM synonym number and forward the call to GSM 20 with it.
 - The service cloud need not be consulted. If it is consulted, the advice "Session forwarding on mobile not reachable" is
30 not followed.
 - if the identifier, e.g. E.164, is the IMS synonym number (i.e. the session e.g. call is coming from GSM network 20), translate the identifier when needed, e.g. E.164 to the original number, consult the service cloud and follow the

advice "Session forwarding on mobile not reachable" if available, or release the call if no advice is available.

3) If the call is released and the E.164 is the GSM synonym number i.e. the GSM network 20 releases the call (because
5 e.g. the subscriber is unregistered in GSM), translate the E.164 to the original number when needed, consult the service cloud 16 and follow the advice "Session forwarding on mobile not reachable" if available, or release the call if no advice is available.

10

The functionality at GMSC 22 in CS network 20 is as follows:

1) Do the HLR 21 query always with the original identifier, e.g. E.164.

15 - Translate the E.164 from synonym (i.e. the routing number) to the original E.164 if needed.

2) If the subscriber is registered in HLR 21, translate the E.164 to the original number when needed and route the session with the routing number received from HLR 21.

20 3) If the subscriber is unregistered in HLR 21:

- if the identifier, e.g. E.164 is the original identifier, e.g. E.164 (i.e. the session is not coming from IMS 12), translate the identifier to the IMS synonym number and forward the call to IMS 12 with this synonym number. Possible
25 advice "Call forwarding on mobile not reachable" from IN, Intelligent Network, (or somewhere else) is not followed.

- if the identifier, e.g. E.164, is the GSM synonym number (i.e. the call is coming from IMS 12), translate the identifier to the original number when needed, possibly
30 consult IN (or possibly some other information source) and follow the advice "Call forwarding on mobile not reachable" if available, or release the session if no advice is available.

4) If the session is released and the identifier, e.g. E.164

is the IMS synonym number i.e. the IMS network 12 releases the session (because e.g. the subscriber is unregistered in IMS 12), translate the identifier to the original number when needed, possibly consult IN (or possibly some other
5 information source) and follow the advice "Call forwarding on mobile not reachable" if available, or release the session if no advice is available.

Advantages of these solutions according to Figs. 3, 4 are:

- 10 a) Quite simple,
- b) No changes to GSM network needed, only routing has to be slightly reconfigured,
- c) Offers the possibility to prioritize one of the networks according to the subscriber's preferences, e.g. have voice
15 mail only in GSM 12 and not on both networks.

In the examples according to Figs. 3, 4:

the original identifier is the E.164 number:	358-40-1223344
20 the GSM synonym is:	358-49-1223344
the IMS synonym is:	358-48-1223344
FQDN of the operator's IMS:	ims.sonera.fi.

The embodiment shown in Fig. 3 and 4 comprises the structural
25 components as shown and described with regard to Figs. 1, 2, and additionally a voice mail component/device or function
24.

First, the functioning of this embodiment will be explained
30 with reference to the arrow numbering of Fig. 3, and the use of an identifier which is the E.164 number (that is an IMS and GSM number).

Step 1: INVITE message to I-CSCF 13 from calling terminal 11'

with identifier 358401223344@ims.sonera.fi.

Step 2: Location request to HSS 14 with
358401223344@ims.sonera.fi.

Step 3: Because the subscriber is not registered in IMS, HSS
5 14 does not assign a S-CSCF to the session, e.g. call. The I-
CSCF 13 chooses a S-CSCF 15 for the session.

Step 4: INVITE message to the selected S-CSCF 15 with
358401223344@ims.sonera.fi and with information that the
subscriber is unregistered in the IMS network 12.

10 Step 5: The S-CSCF 15 may make a query to the service cloud
16 with the original identifier 358401223344@ims.sonera.fi.

Step 6: The service cloud 16 may return advice "Session
forwarding on mobile not reachable". The advice is not
followed. The GSM synonym 358-49-1223344 is generated by S-
15 CSCF 15 from the original identifier, E.164.

Step 7: S-CSCF 15 sends an INVITE message further to BGCF 17
with the GSM synonym +358-49-1223344.

Step 8: BGCF 17 chooses the correct MGCF 18 and sends an
INVITE message to it.

20 Step 9: MGCF 18 sends a setup request to GMSC 22 with the GSM
identifier +358-49-1223344.

Step 10: A Location request indicating +358-40-1223344 (i.e.
the original E.164) is generated by GMSC 22 and sent to HLR
21. Because the subscriber is unregistered in HLR 21, an IN
25 (or some other information source) is consulted, and the
advice "Call forwarding on mobile not reachable" is followed
if available, otherwise the session is released.

Step 11: The session is routed e.g. to voice mail 24 with the
original E.164.

30

The solution can also incorporate, in IMS network 12, a
service like "Voice call forwarding on mobile not reachable".
Then only those calls that can be forwarded to GSM 20 (at
least QoS is checked) are forwarded there.

When the identifier used in the embodiment of Fig. 3 is e.g. SIP-URL instead of E.164 number, the following steps may be performed:

5

Step 1: INVITE to I-CSCF 13 with john.smith@ims.sonera.fi.

Step 2: Location request from I-CSCF 13 to HSS 14 with john.smith@ims.sonera.fi.

Step 3: Because the subscriber is not registered in IMS, no
10 S-CSCF 15 is assigned to the subscriber. HSS 14 returns the original E.164 number to I-CSCF 13. I-CSCF 13 chooses a S-CSCF 15 for the session.

Steps 4-11 are like above except in the step 4 and/or 5 the S-CSCF fetches the original E.164 number from the
15 subscriber's profile if HSS did not returned it..

The embodiment of Fig. 4 illustrates the method flow in case of receiving a session request by the network 20. First, a case is explained when the used identifier is the E.164
20 number (that is an IMS and GSM number).

Step 1: A Setup request is sent to GMSC 22 from a calling terminal 11' with identifier +358-40-1223344.

Step 2: A Location request with this identifier +358-40-1223344 (i.e. with the original E.164) is sent from GMSC 22
25 to HLR 21. The called subscriber is unregistered in HLR 21. Because the identifier E.164 is the original number, it is translated by GMSC 22 or HLR 21 to IMS synonym i.e. +358-48-1223344.

Step 3: GMSC 22 sends a Setup request to MGCF 18 indicating
30 the identifier 358-48-1223344.

Step 4: MGCF 18 sends an INVITE message to I-CSCF 13 with identifier 358-48-1223344@ims.sonera.fi which is generated by MGCF 18 based on the received identifier 358-48-1223344 and the IMS identifier ims.sonera.fi.

Step 5: I-CSCF 13 generates an identifier 358401223344@ims.sonera.fi (i.e. with the original E.164) and sends a Location request to HSS 14 with this identifier 358401223344@ims.sonera.fi.

- 5 Step 6: Because the subscriber is not registered in IMS, no S-CSCF 15 is assigned from HSS 14 to the session. I-CSCF 13 chooses a S-CSCF 15 for the session.

Step 7: I-CSCF 13 sends an INVITE message to the selected S-CSCF 15 with the IMS identifier 358481223344@ims.sonera.fi
10 and with information that the subscriber is unregistered.

Step 8: S-CSCF 15 makes a query to the service cloud 16 with the original number 358-40-1223344 generated by S-CSCF 15 based on the identifier received from I-CSCF 13.

Step 9: The service cloud 16 may return advice "Session
15 forwarding on mobile not reachable". If the advice is returned, it is followed. Otherwise the call is released. In this example the call is released.

Step 10: A Release command is sent from S-CSCF 15 to I-CSCF 13 for releasing the session 358481223344@ims.sonera.fi.

20 Step 11: A Release command including the identifier 358481223344@ims.sonera.fi is sent from I-CSCF 13 to MGCF 18.

Step 12: A Release command including the identifier 358-48-1223344 is sent from MGCF 18 to GMSC 22. GMSC 22 checks and detects that the call is released and the E.164 is the IMS
25 synonym number. GMSC 22 translates the E.164 to the original number, possibly consults IN (or possibly some other information source) and follows the advice "Call forwarding on mobile not reachable" if available, or release the call if no advice is available. In this example the advice is to
30 route the call to voice mail.

Step 13: The call is routed with 358-40-1223344 to voice mail 24.

In the above embodiments, the functionality of CS network is

not changed i.e. the IMS works together with any customary type of GSM network. Further, the same identifier, e.g. the E.164 number, identifies the subscription in both networks, e.g. IMS and GSM. A dual-mode terminal (Dual terminal) is
5 used which can register to IMS and GSM.

The invention can be implemented to support also other technologies or networks than IMS and GSM. The concept "registered in GSM" means attached in GSM while the concept
10 "unregistered in GSM" means detached from GSM. The names "Session forwarding on mobile not reachable", "Call forwarding on mobile not reachable", "Conditional session forwarding on mobile not reachable", "Voice call forwarding on mobile not reachable", and alike should not be considered
15 as exact names but descriptive names of service, functionality, functional procedure or alike.

Although the invention has been described above with reference to specific embodiments, the scope of the invention
20 also covers any alterations, additions, modifications, and omissions of the disclosed features.

CLAIMS

5

1. Method for providing interworking between a first and a second network of different types, wherein a terminal can be registered to the first network and/or to the second network, wherein a session request, e.g. a call, received by
10 the first network and directed to a terminal unregistered from the first network, is forwarded to the second network, whereas when the session request is received by the second network and is directed to a terminal unregistered from the second network, the session request is not forwarded to the
15 first network.

2. Method according to claim 1, wherein the first network is an IP-based network, preferably an IMS (IMS; IP Multimedia Subsystem) network, and the second network is a CS
20 (Circuit-Switched) network.

3. Method according to claim 1 or 2, wherein the same identifier, preferably the same E.164 number, is used in both networks for identifying the called terminal.

25

4. Method according to any one of the preceding claims, wherein the terminal is informed, preferably after every location update, on its registration in the second network.

30 5. Method according to any one of the preceding claims, wherein the first network is informed on the registration of the terminal to the second network, the first network using this information as basis for the decision whether or not to route a session request to the second network.

6. Method according to any one of the preceding claims,
wherein after a location update in the second network, the
terminal sends a message/information to the first network,
5 the first network recording the time of the location update.

7. Method according to any one of the preceding claims,
wherein, when the dual terminal is switched off, the terminal
sends a message/information to the first network indicating
10 the switching-off, the first network recording the state
"switched off" i.e. "unregistered from second network".

8. Method according to any one of the preceding claims,
wherein, when the terminal unregisters from the second
15 network, the terminal sends a message/information to the
first network indicating that the terminal will unregister
from the second network, the first network recording the
state "unregistered from second network".

20 9. Method according to any one of the preceding claims,
wherein information about registration in the first network
is continuously available in a server.

10. Method according to any one of the preceding claims,
25 wherein, when the terminal is not registered in the first
network, it is checked whether the terminal is registered in
the second network.

11. Method according to claim 10, wherein, for checking
30 whether the terminal is registered in the second network,
information gathered from the terminal is utilized.

12. Method according to any one of the preceding claims,
wherein, when detecting that the terminal is unregistered

from the second network, the session request is not forwarded to the second network, whereas, when detecting that the terminal is registered to the second network, the session request is forwarded to the second network.

5

13. Method according to any one of the preceding claims, wherein the time duration elapsed since the time point of registration of the terminal to the second network is checked, and when the time duration is shorter than a certain
10 period, the session request is forwarded to the second network, otherwise the session request is not forwarded.

14. Method according to any one of the preceding claims, wherein the first network provides a session forwarding
15 service that is used when the subscriber is not reachable in the first network and the session request characteristics indicate that the session request can be successfully routed to the second network.

20 15. Method according to any one of the preceding claims, wherein the session forwarding service is a service for conditional voice call forwarding on mobile not reachable in the first network".

25 16. Method according to any one of the preceding claims, wherein one of the components of the first network checks whether the connection request to terminal 11 is a voice call request or a request of another type that can be successfully
30 routed to the second network, and wherein the forwarding service is continued only when detecting, in this checking step, that the requested connection represents a voice call.

17. Method according to any one of the preceding claims, wherein the first network inspects, at least when the

terminal is unregistered from the network 12, session characteristics of the intended session for checking the possibility of successfully forwarding the session to the second network.

5

18. Method according to any one of the preceding claims, wherein, when the first network 12 receives a session set-up request including session or call characteristics, it sends this request or at least a request including the session characteristics to an entity which checks, at least when the terminating terminal is unregistered from the first network, the session characteristics for deciding whether or not this session can be routed to the second network.

19. Method according to any one of the preceding claims, wherein an entity of the first network checks whether a media gateway of the first network is able to translate the traffic content of the requested session to a form appropriate for forwarding it to the second network, and, when no proper conversion is available, the entity decides not to forward the session.

20. Method according to any one of the preceding claims, wherein, when the first network detects that the session, e.g. a video call or video stream, can not be successfully routed to the second network, the first network routes such a session to an appropriate entity such as a Video Mail System.

21. Method according to any one of the preceding claims, wherein the first network is structured to route a session directed to an unregistered terminal directly to a media gateway, and, when the gateway returns an error message because of lack of conversion of the traffic and/or signalling of the session, an entity of the first network is

addressed which decides how to further proceed with the requested session.

22. Method according to claim 21, wherein the entity
5 analyzes the session characteristics and instructs the first network to forward, if possible, the session e.g. to an appropriate mail system such as video mail system.

23. Method according to any one of the preceding claims,
10 wherein an interface between an S-CSCF and an entity of the first network use SIP+ or is implemented as a Service Control Point (SCP).

24. System for providing interworking between a first
15 and a second network of different types, wherein a terminal can be registered to the first network and/or to the second network, wherein the system is adapted to forward a session request received by the first network and directed to a terminal unregistered from the first network, to the second
20 network, whereas when the session request is received by the second network and is directed to a terminal unregistered from the second network, the system is adapted not to forward the session request to the first network.

25 25. System according to claim 24, wherein the first network is an IP-based network, preferably an IMS (IMS; IP Multimedia Subsystem) network, and the second network is a CS (Circuit-Switched) network.

30 26. System according to claim 24 or 25, wherein the same identifier, preferably the same E.164 number, is used in both networks for identifying the called terminal.

27. System according to any one of the preceding system

claims, wherein the system is adapted to inform the terminal, preferably after every location update, on its registration in the second network.

5 28. System according to any one of the preceding system claims, wherein the system is adapted to inform the first network on the registration of the terminal to the second network, the first network using this information as basis for the decision whether or not to route a session request to
10 the second network.

29. System according to any one of the preceding system claims, wherein after each successful location update in the second network, the terminal is adapted to send a
15 message/information to the first network, the first network recording the time of the successful location update.

30. System according to any one of the preceding system claims, wherein the terminal is adapted to send, when the
20 terminal is switched off, a message/information to the first network indicating the switching-off, the first network recording the state "switched off" i.e. "unregistered from second network".

25 31. System according to any one of the preceding system claims, wherein the terminal is adapted to send, when the terminal unregisters from the second network, a message/information to the first network indicating that the terminal will unregister from the second network, the first
30 network recording the state "unregistered from second network".

32...System according to any one of the preceding system claims, wherein the first network comprises a server which

stores information about registration of the terminal in the first network.

33. System according to any one of the preceding system
5 claims, wherein the first network is adapted to check, when the terminal is not registered in the first network, whether the terminal is registered in the second network.

34. System according to claim 33, wherein, for checking
10 whether the terminal is registered in the second network, information gathered from the terminal is utilized.

35. System according to any one of the preceding system
15 claims, wherein the system is adapted, when detecting that the terminal is unregistered from the second network, not to forward a session request to the second network, whereas, when detecting that the terminal is registered to the second network, the session request is forwarded to the second
network.

20

36. System according to any one of the preceding system
claims, wherein the system is adapted to check the time
duration elapsed since the time point of registration of the
terminal to the second network, and to forward, when the time
25 duration is shorter than a certain period, the session
request to the second network, which otherwise is not
forwarded.

37. System according to any one of the preceding system
30 claims, wherein the first network provides a supplementary service: "Conditional voice call forwarding on mobile not reachable in the first network".

38. System according to any one of the preceding system

claims, wherein first network is adapted to check whether a connection request to terminal 11 is a voice call request or a request of another type, and to continue the call forwarding to the second network only when detecting that the requested connection represents a voice call.

39. System according to any one of the preceding system claims, wherein the first network provides a session forwarding service that is used when the subscriber is not reachable in the first network and the session request characteristics indicate that the session request can be successfully routed to the second network.

40. System according to any one of the preceding system claims, wherein the session forwarding service is a service for conditional voice call forwarding on mobile not reachable in the first network".

41. System according to any one of the preceding system claims, wherein one of the components of the first network checks whether the connection request to terminal 11 is a voice call request or a request of another type that can be successfully routed to the second network, and wherein the forwarding service is continued only when detecting, in this checking step, that the requested connection represents a voice call.

42. System according to any one of the preceding system claims, wherein the first network inspects, at least when the terminal is unregistered from the network 12, session characteristics of the intended session for checking the possibility of successfully forwarding the session to the second network.

43. System according to any one of the preceding system claims, wherein, when the first network receives a session set-up request including session or call characteristics, it sends this request or at least a request including the session characteristics to an entity which checks, at least when the terminating terminal is unregistered from the first network, the session characteristics for deciding whether or not this session can be routed to the second network.

44. System according to any one of the preceding system claims, wherein an entity of the first network checks whether a media gateway of the first network is able to translate the traffic content of the requested session to a form appropriate for forwarding it to the second network, and, when no proper conversion is available, the entity decides not to forward the session.

45. System according to any one of the preceding system claims, wherein, when the first network detects that the session, e.g. a video call or video stream, can not be successfully routed to the second network, the first network routes such a session to an appropriate entity such as a Video Mail System.

46. System according to any one of the preceding system claims, wherein the first network is structured to route a session directed to an unregistered terminal directly to a media gateway, and, when the gateway returns an error message because of lack of conversion of the traffic and/or signalling of the session, an entity of the first network is addressed which decides how to further proceed with the requested session.

47. System according to claim 46, wherein the entity

analyzes the session characteristics and instructs the first network to forward, if possible, the session e.g. to an appropriate mail system such as video mail system.

5 48. System according to any one of the preceding system claims, wherein an interface between an S-CSCF and an entity of the first network use SIP+ or is implemented as a Service Control Point (SCP).

10 49. Method for providing interworking between a first and a second network of different types, wherein a subscriber entity can be registered to the first network and/or to the second network, wherein a call received by the first network and directed to a subscriber entity unregistered from the
15 first network, is forwardable to the second network,
- the forwarding step comprises the following steps:
- issueing an enquiry to service execution means, the enquiry carrying call characteristics,
- the service execution means arranged to be aware of the
20 conversion capabilities of a gateway means providing media stream conversion between said first and second network,
- the service execution means inspecting call characteristics,
- the service execution means making a decision as to whether
25 the call characteristics are such that at least one media stream related to the call can be converted by the gateway means,
- issueing from the service execution means a forwarding request to the second network based on the said decision.

30

50. System for providing interworking between a first and a second network of different types, wherein a subscriber entity can be registered to the first network and/or to the second network, wherein a call received by the first network

and directed to a subscriber entity unregistered from the first network, is forwardable to the second network,

- the system comprising means for carry-out the following steps for providing the call forwarding:

- 5 - issuing an enquiry to service execution means, the enquiry carrying call characteristics,
- the service execution means arranged to be aware of the conversion capabilities of a gateway means providing media stream conversion between said first and second network,
- 10 - the service execution means inspecting call characteristics,
- the service execution means making a decision as to whether the call characteristics are such that at least one media stream related to the call can be converted by the gateway
- 15 means,
- issuing from the service execution means a forwarding request to the second network based on the said decision.

51. Method for providing interworking between a first
20 and a second network of different types, wherein a terminal can be registered to the first network and/or to the second network, wherein a session request received by the first network and directed to a terminal unregistered from the first network, is forwarded to the second network together
25 with an information indicating that the session request was forwarded from the first network.

52. Method according to claim 51, wherein the first
and/or second network are designed to check the information
30 and to suppress the forwarding of a session request forwarded from another network back to this another network.

53. Method according to claim 51 or 52, wherein the information is an identifier for identifying the unregistered

terminal, the identifier being changed when forwarding the session request from one of the networks to another one of the networks.

5 54. System for providing interworking between a first and a second network of different types, wherein a terminal can be registered to the first network and/or to the second network, wherein the system is adapted to forward a session request received by the first network and directed to a
10 terminal unregistered from the first network, to the second network together with an information indicating that the session request was forwarded from the first network.

 55. System according to claim 54, wherein the first
15 and/or second network are designed to check the information and to suppress the forwarding of a session request forwarded from another network back to this another network.

 56. System according to claim 54 or 55, wherein the
20 information is an identifier for identifying the unregistered terminal, the identifier being changed when forwarding the session request from one of the networks to another one of the networks.

B IS UNREGISTERED FROM IMS, THE CALL IS FORWARDED TO GSM

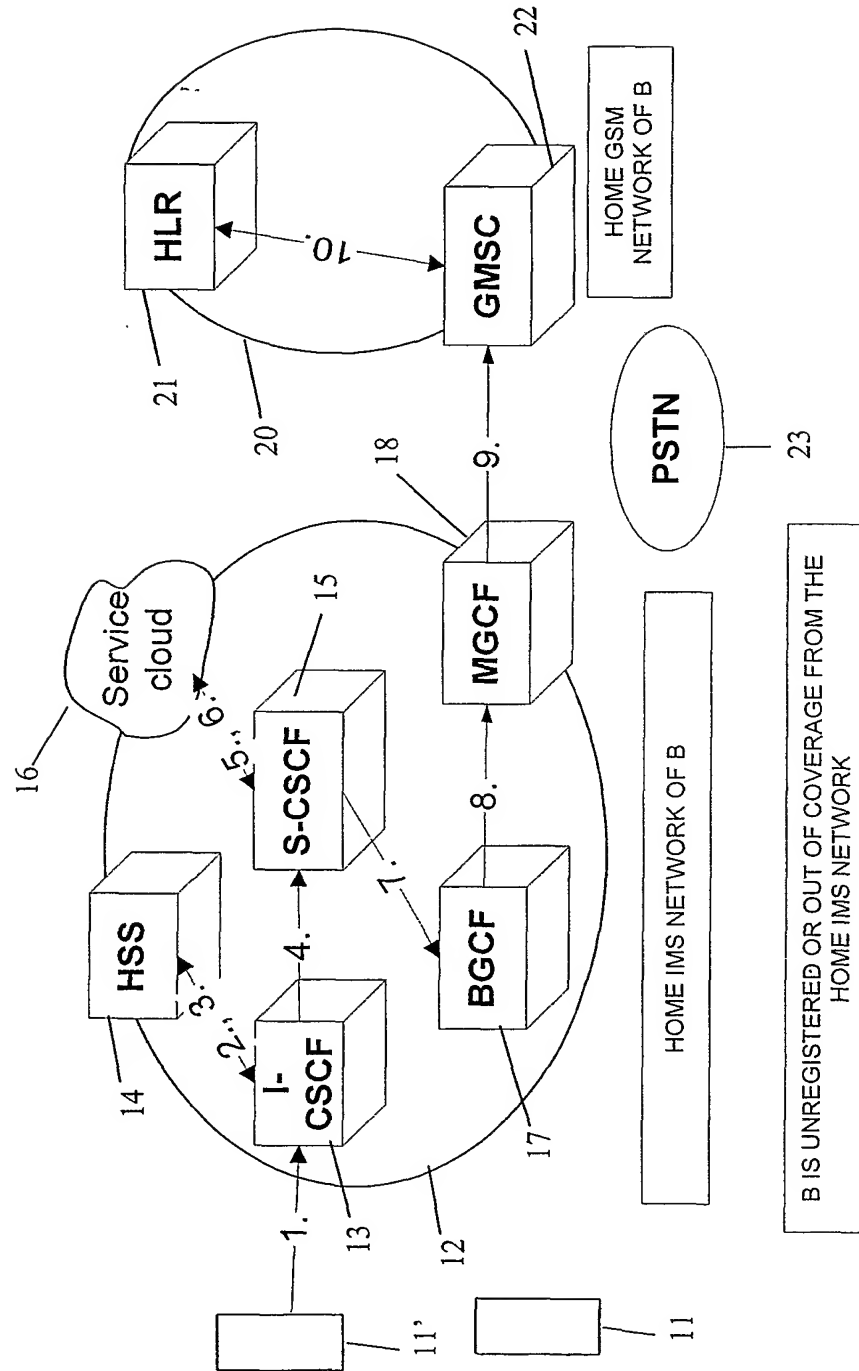


FIG. 1

B IS UNREGISTERED FROM GSM, THE CALL IS NOT FORWARDED TO IMS

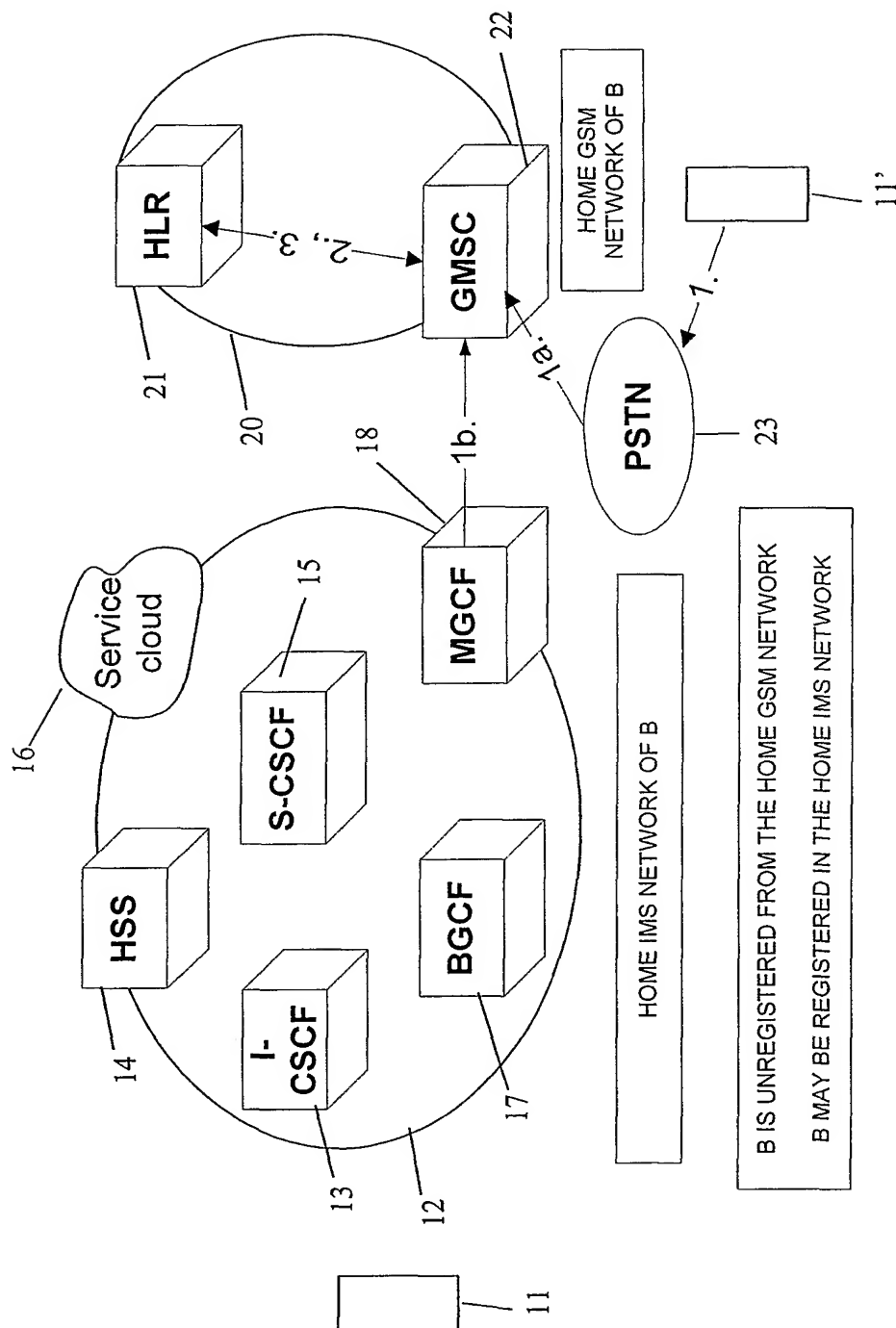


FIG. 2

SUBSCRIBER B IS UNREGISTERED IN IMS AND GSM

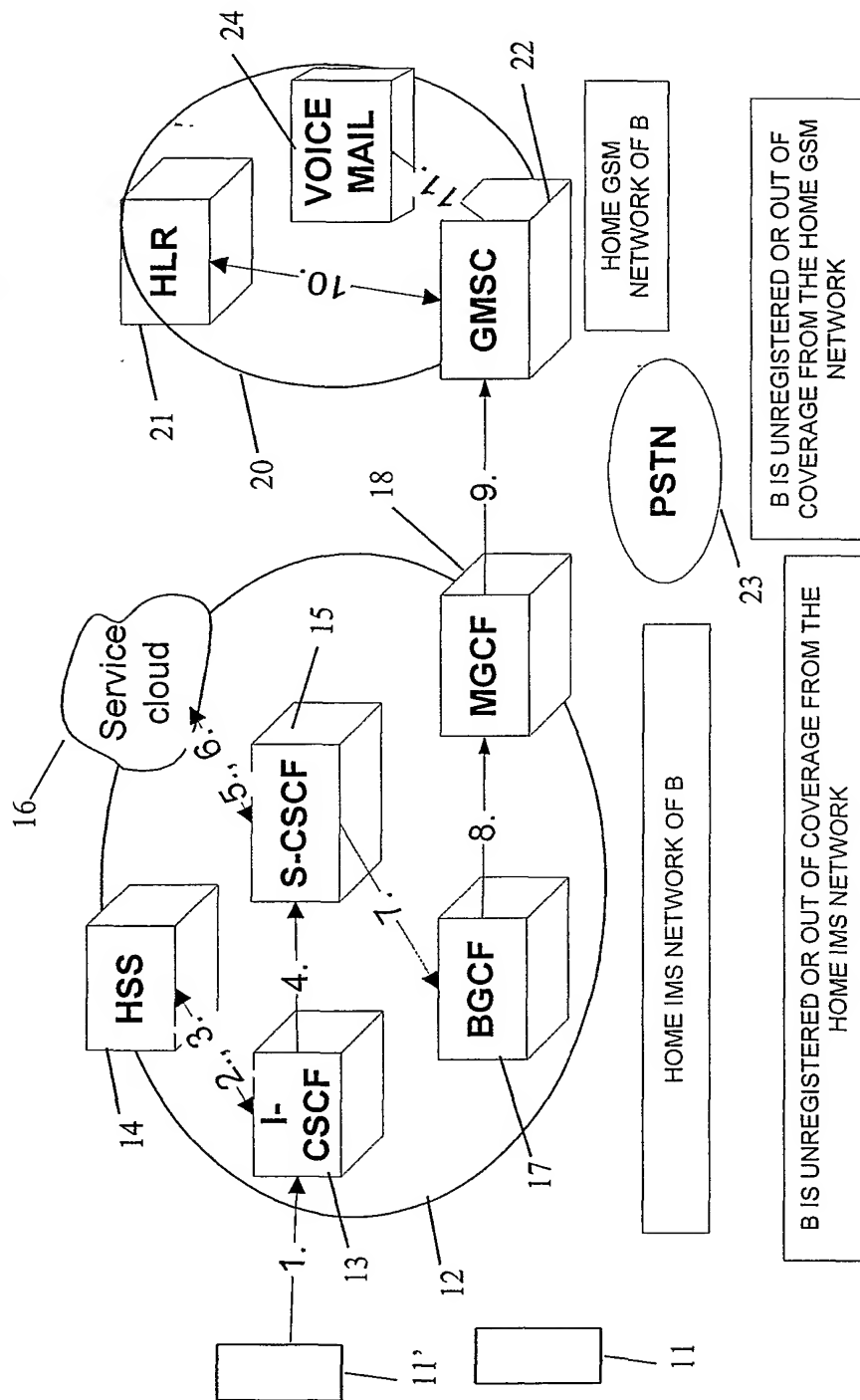


FIG. 3

SUBSCRIBER B IS UNREGISTERED IN IMS AND GSM

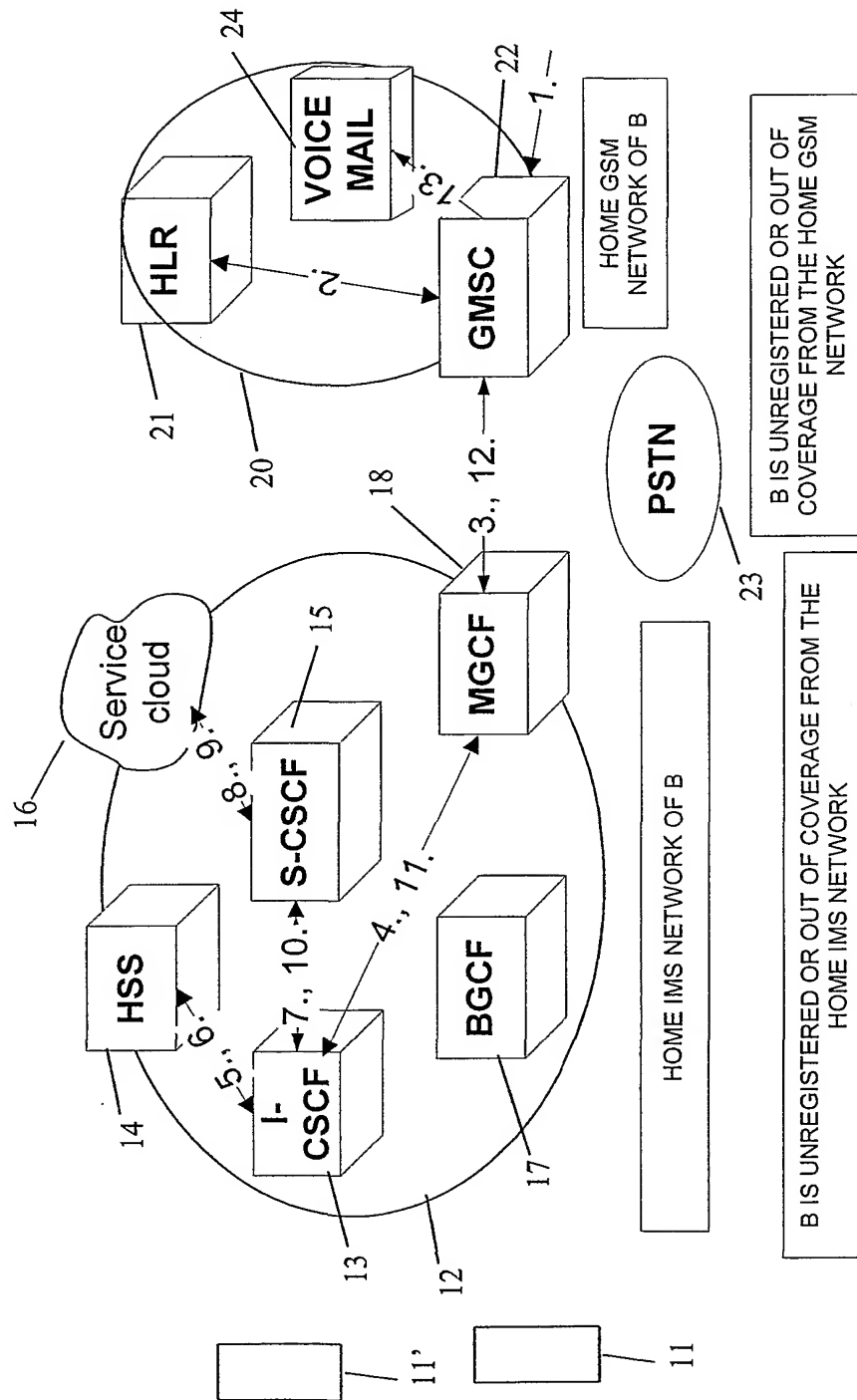


FIG. 4

INTERNATIONAL SEARCH REPORT

International Application No

PCT, EP 01/06975

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y		1-48,52, 53,55,56
Y	EP 0 948 231 A (LUCENT TECHNOLOGIES INC) 6 October 1999 (1999-10-06) column 2, line 36 - line 44 column 3, line 30 -column 4, line 56 abstract	1-48,52, 53,55,56
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

1 February 2002

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/06975

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

International Application No

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